

## CLAIMS

*Subs  
A1*

What is claimed is:

1. In a computer system executing a software stream that removes a block of heap memory from a heap pile for use by a hardware device, a method comprising:
  - 3 returning the block of heap memory to the heap pile by the hardware device.

- 1 2. The method as defined in claim 1 wherein returning the block of heap memory to the heap pile by the hardware device further comprises placing, in a linked list heap memory management system, the block of heap memory at an end of the linked list by the hardware device.

- 1 2 3. The method as defined in claim 2 wherein placing the block of heap memory at the end of the linked list by the hardware device further comprises:

writing a null to a next block field of the block of heap memory;

writing a block number of the block of heap memory to a next block field of a last block of heap memory in the linked list;

6 7 changing the contents of a bottom register to point to the block of heap memory; and thereby

8 making the block of heap memory a last entry in the linked list.

- 1 2 3 4. The method as defined in claim 3 further comprising returning, by the software stream, a second block of heap memory by placing the second block of heap memory at a beginning of the of the linked list.

1 5. The method as defined in claim 4 wherein placing the second block of heap memory at the  
2 beginning of the linked list by the software stream further comprises:

3 determining a block number of a primary block of heap memory resident at the beginning  
4 of the linked list;

5 writing the block number of the primary block of heap memory to a next block field of the  
6 second block; and

7 writing atomically a block number of the second block to a top register.

4 6. The method as defined in claim 5 wherein determining a block number of a primary block  
5 of heap memory resident at the beginning of the linked list further comprises reading the top  
6 register prior to the step of writing the block number of the second block.

7 7. The method as defined in claim 2 further comprising removing, by the software stream,  
8 heap memory from the linked list heap management system.

1 8. The method as defined in claim 7 wherein removing heap memory from the linked list heap  
2 management system further comprises taking a primary block of heap memory resident at a  
3 beginning of the of the linked list.

1 9. The method as defined in claim 8 wherein taking a primary block of heap memory resident  
2 at a beginning of the of the linked list further comprises:

3 determining a block number of the primary block;

4 reading a next block field of the primary block of memory; and

5 removing the primary block if the next block field of the primary block does not indicate a  
6 null.

1 10. The method as defined in claim 9 wherein determining a block number of the primary  
2 block further comprises reading a top register, wherein the top register identifies the beginning of  
3 the linked list.

1 11. The method as defined in claim 9 wherein removing the primary block if the next block  
2 field of the primary block does not indicate a null further comprises writing a block number of the  
3 next block field of the primary block to the top register.

12. A method of managing a heap memory comprising:

1 maintaining unused blocks of heap memory as a linked list, and wherein the unused blocks  
2 of the linked list comprise a first block at a beginning of the linked list, a second block pointed to  
3 the first block, and a third block at an end of the linked list;

5 removing, by a software stream, the first block from the linked list, thus making the second  
6 block the beginning of the linked list; and

7 returning, by a hardware device, a return block to the linked list by placing the return block  
8 at an end of the linked list.

1 13. The method of managing a heap memory as defined in claim 12 wherein returning, by a  
2 hardware device, a return block to the linked list by placing the return block at an end of the linked  
3 list further comprises:

4 writing a null to a next block field of the return block;  
5 reading a bottom register, the bottom register identifying the third block;  
6 writing a block number of the return block to a next state field of the third block; and  
7 writing the block number of the return block to the bottom register.

1 14. The method of managing a heap memory as defined in claim 12 wherein removing, by a  
2 software stream, the first block from the linked list further comprises:

3 reading a top register, the top register identifying the first block;  
4 reading a next block field of the first block, the next block field of the first block  
identifying the second block; and  
5 writing a block number of the second block to the top register.

6 15. The method of managing a heap memory as defined in claim 14 wherein writing a block  
7 number of the second block to the top register further comprises atomically writing the block  
number of the second block to the top register.

1 16. The method of managing a heap memory as defined in claim 12 further comprising  
2 returning, by a software stream, a fourth block to the linked list by placing the fourth block at the  
3 beginning of the linked list, thus making the fourth block the beginning of the linked list.

1 17. The method of managing a heap of memory as defined in claim 16 wherein returning a  
2 fourth block to the linked list by placing the fourth block at the beginning of the linked list further  
3 comprises:

4 reading a top register, the top register identifying the beginning of the linked list;  
5 writing a block number of the block identified by the top register to a next state field of the  
6 fourth block; and  
7 writing a block number of the fourth block to the top register.

1 18. The method of managing a heap memory as defined in claim 17 wherein writing a block  
2 number of the fourth block to the top register further comprises atomically writing the block  
3 number of the fourth block to the top register.

19. A method of managing a heap memory in a computer system, the method comprising:  
allowing a software thread to add and remove blocks of heap memory from a linked list of  
free blocks of heap memory in a last-in/first-out (LIFO) fashion at a first end of the linked list; and  
allowing a hardware device to add blocks of heap memory to the linked list of free blocks  
of heap memory at a second end of the linked list.

1 20. The method of managing a heap memory in a computer system as defined in claim 19  
2 wherein allowing a software thread to remove blocks of heap memory in LIFO fashion further  
3 comprises:

4 determining, by the software thread, a block number of a block of heap memory at the first  
5 end of the linked list; and  
6 removing the block of heap memory at the first end of the linked list.

1 21. The method of managing a heap memory in a computer system as defined in claim 20  
2 determining a block number of a block of heap memory at the first end of the linked list further  
3 comprises reading a beginning register that stores a block number of a block of heap memory at the  
4 first end of the linked list.

1 22. The method of managing a heap memory in a computer system as defined in claim 21  
2 wherein removing the block of heap memory at the first end of the linked list further comprises:  
3 reading a next block field of the block of heap memory at the first end of the linked list to  
4 identify a block number of a next block in the linked list; and  
5 writing the block number of the next block in the linked list to the beginning register.

1 23. The method of managing a heap memory in a computer system as defined in claim 20  
2 wherein allowing a software thread to add blocks of heap memory in LIFO fashion further  
3 comprises:

4 determining, by the software thread, a block number of a block of heap memory at the first  
5 end of the linked list;  
6 writing the block number of the block of heap memory at the first end of the linked list to a  
7 next block field of a return block of heap memory; and  
8 making the return block of heap memory the first end of the linked list.

1 24. The method of managing a heap memory in a computer system as defined in claim 23  
2 wherein determining a block number of a block of heap memory at first end of the linked list

3 further comprises reading a beginning register that stores a block number of a block of heap  
4 memory at the first end of the linked list.

1 25. The method of managing a heap memory in a computer system as defined in claim 24  
2 wherein making the return block of heap memory the first end of the linked list further comprises  
3 writing a block number the return block of heap memory to the beginning register.

1 26. The method of managing a heap memory in a computer system as defined in claim 20  
2 wherein allowing a hardware device to add blocks of heap memory to the linked list of free blocks  
3 of heap memory at a second end of the linked list further comprises:  
4  
5 determining, by the hardware device, a block number of a block of heap memory the  
6 second end of the linked list;

7 writing, by the hardware device, a block number of a return block of heap memory to a  
8 next block field of the block of heap memory at the second end of the linked list; and

9 making the return block of heap memory the second end of the linked list.

1 27. The method of managing a heap memory in a computer system as defined in claim 26  
2 wherein determining a block number of a block of heap memory at the second end of the linked list  
3 further comprises reading an end register that stores a block number of the block of heap memory  
4 at the second end of the linked list.

1 28. The method of managing a heap memory in a computer system as defined in claim 27  
2 wherein making the return block of heap memory the second end of the linked list further  
3 comprises writing a block number the return block of heap memory to the end register.

1 29. A computer system comprising:  
2 a microprocessor executing a software stream;  
3 a main memory array, a portion of the main memory array allocated to be a heap memory,  
4 and unused portions of the heap memory part of a heap pile;  
5 a first bridge logic device coupling the microprocessor to the main memory array;  
6 a hardware device coupled to the heap memory through the first bridge logic device;  
7 a graphics card coupled to the first bridge logic device, and also coupled to a video display  
8 device;  
9 wherein the software stream executed on the microprocessor removes blocks of heap  
10 memory from the heap pile for use by the hardware device; and  
11 wherein the hardware device returns blocks of heap memory to the heap pile without  
12 intervention from the software stream executed by the microprocessor.

1 30. The computer system as defined in claim 29 wherein the heap memory further comprises:  
2 a plurality of blocks, each block having the same number of bytes;  
3 each block having a next block field; and  
4 wherein the heap pile is maintained as a linked list, each block's next block filed pointing  
5 to a next block in the list.

1 31. The computer system as defined in claim 30 wherein the linked list of blocks further  
2 comprises:

3 a top end being the beginning of the linked list;

4 a bottom end being the bottom of the linked list; and

5 wherein the software stream removes blocks from the heap pile by removing blocks from  
6 the top end, and the hardware device returns blocks to the heap pile at the bottom end.

1 32. The computer system as defined in claim 31 further comprising the software stream returns  
2 blocks to the heap pile at the top end.

33. The computer system as defined in claim 29 wherein the hardware device is the graphics  
card.

34. The computer system as defined in claim 29 wherein the hardware device is a network  
interface card.

1 35. The computer system as defined in claim 29 wherein the hardware device is an audio card.

1 36. The computer system as defined in claim 29 wherein the hardware device is a mass storage  
2 device.

1 37. The computer system as defined in claim 36 wherein the mass storage device is a hard  
2 drive.

1    38.    The computer system as defined in claim 37 wherein the mass storage device is compact  
2    disk storage device.

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